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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/584,037	06/21/2006	Erik Petrus Antonius Bakkers	NL03 1430 US1	6994

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PO BOX 3001
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EXAMINER	
HAMLIN, JR, KENNETH B	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/584,037	BAKKERS ET AL.	
	Examiner	Art Unit	
	KENNETH HAMLIN	4148	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 July 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) *20-29* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 June 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20060621*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Applicant's election with traverse of Group I, claims 1-19 in the reply filed on 7/13/2009 is acknowledged. The traversal is on the ground(s) that Groups I, II, III, and IV share the same technical features. This is not found persuasive because the restriction filed on 6/11/2009 states A Posteriori lack of unity such that the shared common technical feature of a nanowire is already known in the art as shown in the reference Journal of Physics and Chemistry B 2001, 105, 6838-6845 Torimoto et al.

The requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by US 4,518,456 (Bjorkholm).

Regarding Claim 1; Bjorkholm discloses a method of fabricating a set of semiconducting nanowires having a desired wire diameter, the method comprising the steps of:

Providing a set of pre-fabricated semiconducting nanowires (66), at least one pre-fabricated semiconducting nanowire having a wire diameter larger than the desired wire diameter, and

Reducing the wire diameter of the at least one pre-fabricated nanowire (66) by etching, the etching being induced by electromagnetic radiation (52) which is absorbed by the at least one pre-fabricated nanowire (66), a minimum wavelength of the electromagnetic radiation being chosen such that the absorption of the at least one pre-fabricated nanowire (66) being significantly reduced when the at least one pre-fabricated nanowire reaches the desired wire diameter (Fig. 1) (Col. 2 line 58 - Col. 3, line 7).

Regarding Claim 2; Bjorkholm discloses a radiation source (52) is used which emits the electromagnetic radiation (52) inducing the etching and electromagnetic radiation (52) having a wavelength shorter than the minimum wavelength (Col. 3, lines 5-8), and

The electromagnetic radiation (52) emitted by the radiation source (52) is spectrally filtered (56) for substantially reducing electromagnetic radiation having a wavelength shorter than the minimum wavelength (Col. 3, lines 6-7).

Regarding Claim 3; Bjorkholm discloses that prior to the step of reducing the wire diameter substantially all the pre-fabricated semiconducting nanowires have a diameter larger than or equal to the desired wire diameter (abstract).

Regarding Claim 8; Bjorkholm discloses that the etching can result in a diameter of zero (holes 130, Fig. 6).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 4-7, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 4,518,456 (Bjorkholm) in view of "Different behavior of photoluminescence anisotropy in porous silicon layers made by polarized-light-assisted electrochemical etching" (Hideki).

Regarding Claim 4; Bjorkholm does not disclose that the light inducing the etch treatment is linearly polarized along an axis.

However, Hideki does disclose the use of linearly polarized light in an etch treatment (abstract). Hideki teaches the advantages of using polarized light during etching is that the direction of the anisotropy is easily changed by changing the direction of the polarization of the light (Col. 1, par. 3). It would have been obvious to one of ordinary skill in the art at the time of the invention to used

polarized light to induce the etching as taught by Hideki in the method of Bjorkholm so that the direction of the anisotropy is easily changed.

Regarding Claim 5; Bjorkholm does not disclose that the light inducing the etch treatment has a first component being linearly polarized along a first axis and a second component being linearly polarized along a second axis forming an angle larger than zero with the first axis.

However, Hideki does disclose the use of polarized light along two different axis with an angle larger than zero between them (first paragraph, I parallel and I perpendicular). Hideki teaches the advantages of using polarized light during etching is that the direction of the anisotropy is easily changed by changing the direction of the polarization of the light (Col. 1, par. 3). It would have been obvious to one of ordinary skill in the art at the time of the invention to used polarized light to induce the etching as taught by Hideki in the method of Bjorkholm so that the direction of the anisotropy is easily changed.

Regarding Claim 6; Bjorkholm does not disclose that the first component has a first spectrum with a first minimum wavelength and the second component has a second spectrum with a second minimum wavelength different from the first minimum wavelength.

However, Hideki discloses the use of different angles of polarization and the use of different energy bands (wavelengths). Hideki teaches that different intensities have different etch rates (Fig. 2). It would have been obvious to one of

ordinary skill in the art at the time of the invention to used polarized light to induce the etching as taught by Hideki in the method of Bjorkholm so that the proper etch rate can be chosen.

Regarding Claim 7; Bjorkholm does not disclose that the first component has a first intensity and the second component has a second intensity different from the fist intensity.

However, Hideki does disclose the use of different components with different intensities to assist the etching. Hideki teaches that different intensities have different etch rates (Fig. 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to used polarized light to induce the etching as taught by Hideki in the method of Bjorkholm so that the proper etch rate can be chosen.

Regarding Claim 9; Bjorkholm discloses that the desired diameter can be zero, but does not disclose that the light that induces the etching is linearly polarized.

However, Hideki does disclose the use of linearly polarized light in an etch treatment. Hideki teaches the advantages of using polarized light during etching is that the direction of the anisotropy is easily changed by changing the direction of the polarization of the light (Col. 1, par. 3). It would have been obvious to one of ordinary skill in the art at the time of the invention to used polarized light to

induce the etching as taught by Hideki in the method of Bjorkholm so that the direction of the anisotropy is easily changed.

Claims 10-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 4,518,456 (Bjorkholm) in view of "Fabrication of Metal Nanowires Using Microcontact Printing" (Geissler et al.)

Regarding Claim 10; Bjorkholm does not disclose that the pre-fabricated semiconducting Nanowires are supported by a substrate.

However, Geissler et al. does disclose the use of a substrate to support the nanowires in a lithographic technique to form nanowires (Introduction). Geissler et al. teaches that such a technique allows for simultaneous transfer of large-scale patterns with dimensions ranging from several millimeters down to less than 100nm with good accuracy on a 4 in. wafer level, in addition to being time and cost efficient (Introduction, end of first paragraph). It would have been obvious to one of ordinary skill in that art at the time of the invention to use the teachings of Geissler et al. combined with Bjorkholm as a way to form nanowires that has good accuracy and is time and cost efficient.

Regarding Claim 11; Bjorkholm does not disclose that the substrate comprises an electrical conductor, the pre-fabricated semiconducting nanowires being electrically conductively connected to the electrical conductor.

However, Geissler et al. does disclose that the substrate comprises an electrical conductor, the pre-fabricated semiconducting nanowires being electrically conductively connected to the electrical conductor. In the abstract Geissler et al. disclose the use of a metal substrate which is an electrical conductor, the nanowires are grown out of the metal substrate and it would be obvious to one of ordinary skill in the art that such nanowires would be electrically conductively connected to the electrical conductor. Geissler et al. teaches that such a technique allows for simultaneous transfer of large-scale patterns with dimensions ranging from several millimeters down to less than 100nm with good accuracy on a 4 in. wafer level, in addition to being time and cost efficient (Introduction, end of first paragraph). It would have been obvious to one of ordinary skill in that art at the time of the invention to use the teachings of Geissler et al. combined with Bjorkholm as a way to form nanowires that has good accuracy and is time and cost efficient.

Regarding Claim 12; Bjorkholm does not disclose that the substrate has a surface constituted by a part supported in the pre-fabricated semiconducting nanowires and another part being free from the part, at least the other pat being etch resistant.

However, Geissler et al. does disclose that the substrate has a surface constituted by a part supported in the pre-fabricated semiconducting nanowires and another part being free from the part, at least the other pat being etch resistant (Fig. 1A). Geissler et al. teaches that such a technique allows for

simultaneous transfer of large-scale patterns with dimensions ranging from several millimeters down to less than 100nm with good accuracy on a 4 in. wafer level, in addition to being time and cost efficient (Introduction, end of first paragraph). It would have been obvious to one of ordinary skill in that art at the time of the invention to use the teachings of Geissler et al. combined with Bjorkholm as a way to form nanowires that has good accuracy and is time and cost efficient.

Regarding Claim 13; Bjorkholm does not disclose that the substrate comprises a first layer which is not etch resistant, and a second layer which is etch resistant, the second layer constituting the other part of the surface.

However, Geissler et al. does disclose that the substrate comprises a first layer which is not etch resistant, and a second layer which is etch resistant, the second layer constituting the other part of the surface (Fig. 1A). Geissler et al. teaches that such a technique allows for simultaneous transfer of large-scale patterns with dimensions ranging from several millimeters down to less than 100nm with good accuracy on a 4 in. wafer level, in addition to being time and cost efficient (Introduction, end of first paragraph). It would have been obvious to one of ordinary skill in that art at the time of the invention to use the teachings of Geissler et al. combined with Bjorkholm as a way to form nanowires that has good accuracy and is time and cost efficient.

Regarding Claim 14; Bjorkholm does not disclose that the second layer is connected to the first layer by a chemical bond.

However, Geissler et al. does disclose that the second layer is connected to the first layer by a chemical bond. In the second paragraph of the introduction Geissler et al. discloses several means of creating a second layer on the substrate to protect the metal substrate against a wet etching technique. Geissler et al. teach that such means can change the properties of the substrate and would suggest that a chemical bond is formed thereon. Geissler et al. teaches that such a chemical bond can change the characteristics of the substrate and better assist in the wet etching or the adhesion properties of the substrate. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Geissler et al. with the method of Bjorkholm to better modify the characteristics of the substrate for the purpose of etching.

Regarding Claim 15; Bjorkholm does not disclose that the second layer is composed of on or more materials selected from alkyltriethoxysiloxane and alkyltrimethoxysiloxane.

However, Geissler et al. does disclose that use of alkyltriethoxysiloxane and alkyltrimethoxysiloxane in the second layer of the substrate (Print & Plate Approach, page 6305 second paragraph). Geissler et al. teaches that such a technique allows for simultaneous transfer of large-scale patterns with dimensions ranging from several millimeters down to less than 100nm with good accuracy on a 4 in. wafer level, in addition to being time and cost efficient

(Introduction, end of first paragraph). It would have been obvious to one of ordinary skill in that art at the time of the invention to use the teachings of Geissler et al. combined with Bjorkholm as a way to form nanowires that has good accuracy and is time and cost efficient.

Regarding Claim 16; Bjorkholm discloses providing pre-fabricated semiconducting nanowires, however Bjorkholm does not disclose the following sub-steps of providing a substrate, a surface of the substrate being etchable, and growing semiconducting nanowires on the surface of the substrate, the grown semiconducting nanowires being the pre-fabricated semiconducting nanowires, and after the step of providing the pre-fabricated semiconducting nanowires and prior to the step of reducing the wire diameter of the at least one pre-fabricated semiconducting nanowire by etching the exposed surface of the substrate is covered by an etch resistant layer.

Geissler et al. does disclose the following sub-steps not shown by Bjorkholm: providing a substrate, a surface of the substrate being etchable, and growing semiconducting nanowires on the surface of the substrate, the grown semiconducting nanowires being the pre-fabricated semiconducting nanowires, and after the step of providing the pre-fabricated semiconducting nanowires and prior to the step of reducing the wire diameter of the at least one pre-fabricated semiconducting nanowire by etching the exposed surface of the substrate is covered by an etch resistant layer. Geissler et al. teaches that such a technique allows for simultaneous transfer of large-scale patterns with dimensions ranging

from several millimeters down to less than 100nm with good accuracy on a 4 in. wafer level, in addition to being time and cost efficient (Introduction, end of first paragraph). It would have been obvious to one of ordinary skill in that art at the time of the invention to use the teachings of Geissler et al. combined with Bjorkholm as a way to form nanowires that has good accuracy and is time and cost efficient.

Regarding Claim 17; Bjorkholm discloses that the semiconducting nanowires are irradiated by light for inducing the etch treatment. Bjorkholm does not disclose that pre-fabricated semiconducting nanowires are distributed over the surface and that the pre-fabricated semiconducting nanowires in a second part of the surface being prevented from etching.

However, Geissler et al. does disclose that the pre-fabricated semiconducting nanowires are distributed over the surface (Fig. 1A) and pre-fabricated semiconducting nanowires in a second part of the surface being prevented from etching (Introduction). Geissler et al. teaches that such a technique allows for simultaneous transfer of large-scale patterns with dimensions ranging from several millimeters down to less than 100nm with good accuracy on a 4 in. wafer level, in addition to being time and cost efficient (Introduction, end of first paragraph). It would have been obvious to one of ordinary skill in that art at the time of the invention to use the teachings of Geissler et al. combined with Bjorkholm as a way to form nanowires that has good accuracy and is time and cost efficient.

Regarding Claim 18 and 19; Bjorkholm does not directly disclose that a first part of the surface being irradiated by light having a first minimum wavelength, a second part of the surface being irradiated by light having a second minimum wavelength different from the first minimum wavelength. However, Bjorkholm does discuss the use of different wavelengths of light to induce etching depending on the sample orientation (Col. 3, lines 5-8). It would be obvious to one of ordinary skill in the art at the time of the invention that to make a device with varying wire diameters on different parts of the substrate to use a first minimum wavelength on one part, and a second minimum wavelength on a second part.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KENNETH HAMLIN whose telephone number is (571)270-3341. The examiner can normally be reached on Mon-Fri from 9am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Davienne Monbleau can be reached on (571) 272-1945. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/K. H./
Examiner, Art Unit 2893

/Leonardo Andújar/

Primary Examiner, Art Unit 2826